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ABSTRACT

Within the literature on group counseling and psychotherapy, the structure of therapeutic group processes is frequently described in terms of stages of the group process. Numerous group stages have been proposed to describe the social interaction and change in social interaction that is characteristic of group therapy. This study examined the structure and organization of the social interaction within four therapy groups. Structure and organization were defined for purposes of the study as a function of both the simple unconditional responding of the group participants and the interactive or conditional responding of the participants to each other. Drawing on Shannon and Weaver's (1949) mathematical theory of communication, the interactive structure of the groups was measured in terms of the entropy (or randomness) of the groups' interactions and the redundancy (or patterning) of the interaction. No consistent pattern of organization/disorganization was found to characterize the groups. For the most part, all four groups remained fairly unstructured across their group sessions. No developmental patterns or stages of group development or organization were apparent. Investigation of attempted and achieved dominance within the groups suggested that the frequency with which group members spoke was inversely related to their actual dominance in the groups and the achieved dominance of the group leaders and the group members was fairly equal across groups and across sessions. (Author/NB)

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Order Out of Chaos: A Structural Analysis of Group Therapy

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Abstract

This study examined the structure and organization of the social interaction within four therapy groups. Structure and organization were defined for purposes of this study as a function of both the simple unconditional responding of the group participants and the interactive or conditional responding of the participants to each other. Drawing on Shannon and Weaver's (1949) mathematical theory of communication, the interactive structure of the groups was measured in terms of the entropy (or randomness) of the groups' interaction and the redundancy (or patterning) of the interaction. No consistent pattern of organization/disorganization was found to characterize the groups. For the most part, all four groups remained fairly unstructured across their group sessions. No developmental patterns or "stages" of group development or organization were apparent. Investigation of attempted and achieved dominance within the groups suggested that (a) the frequency with which group members spoken was inversely related to their actual (achieved) dominance in the groups, and (b) the achieved dominance of the group leaders and the group members was fairly equal across groups and across sessions.

Order out of chaos: A structural
analysis of group therapy

Group psychotherapy, as social interaction, may be understood as a process that evidences both flexibility and constraint (Raush, 1965). It is flexible in the sense that the responses of the group members do not, as a rule, invariably result in particular responses from the others. It is constrained in the sense that despite the probabilistic (flexible) nature of the responding, it nevertheless evidences some degree of orderliness to it (Lichtenberg, 1977). That is, although everyone within a group has the potential to speak at any time and following any other group member, there is (or emerges) an organization to the group's interaction. This orderliness of the social interaction in therapy groups is the structure of the group process; it is the regularities or response patterning which occur in the sequence of interactions between and among participants in the group (Duncan & Fiske, 1977; Lichtenberg & Heck, 1986).

Within the literature on group counseling and psychotherapy, the structure of therapeutic group processes is frequently described in terms of "stages" of the group process. Numerous group stages have been proposed to describe the social interaction and change in social interaction that is characteristic of group therapy. In his review of proposed stages of group process, Tuckman (1965) identified four general types of stages that seemed to characterize therapeutic group process theorizing at that time: (a) an initial forming stage characterized by "orientation, testing, and dependence," (b) a storming stage "characterized by conflict, polarization around interpersonal issues, and emotional responding," (c) a norming stage in which "ingroup feeling and cohesiveness develop, new standards evolve and new roles are adopted," and (d) a performing stage in which "(r)oles become flexible and functional . . . and (s)tructural issues have been resolved, and structure can now become supportive of task performance" (p 396). Tuckman's stages were later modified to include a fifth stage (adjourning), with the belief that the process of termination of therapy groups evidences its own characateristic structure and therefore constitutes a unique "stage" in group process (Tuckman & Jensen,

1977). A similar sequence of developmental stages has been proposed by Yalom (1985).

Despite the considerable literature on group processes, it should be noted that most of the proposed stages of group development are the product of non-systematic clinical observation, rather than controlled empirical investigation. Consequently, formal research evidence supporting discrete stages of therapeutic group process is quite limited. Additionally, the research that has undertaken the investigation and confirmation of group stages is frequently confounded by a focus on what is talked about in the group (i.e., the content of the group process) and how it is talked about, rather than on the actual structural properties of the social interaction process itself. In contrast to analysis of the content of a group's social interaction and/or qualifications of that content, the structural analysis of the interaction within a group focuses on the organization of the interaction among group participants. Such an analysis seems more directly relevant to the issue of developmental stages in groups than content analyses of the interaction.

This organization/patterning of interaction can be understood as a function of (a) the simple unconditional responding of the various group participants and (b) the interactive or conditional responding of the participants to each other. With respect to the former, some participants' responses may occur more frequently than others. This differential in the response distribution among group members is, by itself, a response pattern or structure. With respect to the latter, the occurrence of responses by the various group participants may affect the subsequent occurrence of responses by others in the group.

Individual differences may exist among the participants in a group in terms of their contributions to the overall structural pattern of the group's interaction. Some participants may be more or less structured in their responding than others, some participants' responding may be more or less structured by the others in the group, and some may be more or less structuring of the responses of the others (or certain others) in the group.

At issue in the investigation of the structure of social interaction is the constraint each interactant's responding imposes on the responding of the others (and consequently on the overall form or pattern of the interaction). The

focus on constraint follows from a recognition that social interaction in general (and therapeutic group processes in particular) are not strictly deterministic process, but rather are better understood as probabilistic or stochastic processes (Lichtenberg & Hummel, 1976). As a consequence, rather than conceptualizing the events/responses within social interaction processes as being determined by antecedent events, it is more reasonable to describe the occurrence of any particular response event in the group process as "depending to a variable extent" upon events preceding it. More specifically, social interactive events do not cause subsequent events, rather they simply influence the likelihood of those events. Of all the possible "next events" within social interaction, prior events limit or constrain the process such that only certain subsequent events are likely to occur.

There have been various attempts to classify different types of structural forms in terms of the extent of constraint within a system. In social interaction processes (specifically, as discussed in the human communication literature), classifications generally have relied upon the constructs of rigidity, flexibility, and randomness. In the general systems literature, there also has been an emphasis on the constructs of organization and complexity. With respect to these latter two constructs, complexity refers to the variety of response events that occur within social interaction, and organization refers to the degree of integration/interdependence among response events. Penman (1980) has proposed a classification of constraint within social interaction that incorporates the constructs of rigidity, flexibility and randomness within the larger general systems constructs of organization and complexity. The four structural forms of constraint identified by Penman are: (a) organized simplicity (rigidity), (b) organized complexity (flexibility), (c) unorganized simplicity (uniform randomness), and (d) unorganized complexity (multiform randomness).

It was not proposed for the purpose of this study that these structural forms would necessarily conform to any specific group stages. It was proposed, however, that to the extent that therapy group processes are believed to evidence a structure to them, it would be fruitful to investigate this structure and the changes it undergoes (i.e., the "stages" of group process), and to move toward the illumination and documentation of the kinds of social interaction

phenomena that provide the inference base for our clinical views of group therapy process and change.

Drawing upon Shannon and Weaver's mathematical theory of communication (Shannon & Weaver, 1949; also see Attneave, 1959; Lichtenberg & Heck, 1986; Losey, 1978), this study was an attempt to investigate the structure and structural changes that characterize the social interaction process within therapeutic groups. The data analyzed were the interactive verbal behaviors of the group participants, within and across four distinct therapy groups.

Method

Data

Data for analysis consisted of the written transcriptions of four psychotherapy groups. The groups averaged in length from 6 to 9 group sessions (mean length = 7.25 sessions). The number of participants in the groups varied from group to group (and to some extent from session to session, due to the occasional absence of group members). The average number of participants per group was 8.2.

The groups were offered as a part of the regular services of a university counseling center at a major eastern university. All participants were clients of the counseling service; none had been "recruited" to be subjects in the study. All participants had given permission for the recording of the group's interaction and for the transriptions of their interactions to be used in research.

The group interaction was coded according to speaker (participant) and analyzed in terms of the exchanges among participants (i.e., "speaker-switching"). No coding of responses beyond simply designating speech acts by their speaker was attempted.

Analyses

Each group session was analyzed separately in the following manner:

The first analysis involved the calculation of the unconditional frequencies/probabilities of speaking for each participant in the group. More specifically, each participant's proportion of the total number of speaking turns

occurring with each group was determined. A speaking turn was defined as any uninterrupted utterance by a participant. A speaker's proportion of the total number of speaking turns within a group was determined by dividing the number of speaking turns attributed to that speaker by the total number of speaking turns occuring within that group. The proportion of participation of each group member provided information relative to patterns of speaker "domineeringness" (see Rogers-Millar & Millar, 1979) within the groups. The greater the proportion of speaking turns taken by a participant, the more domineering his or her behavior during the group.

A second analysis focused on the interactional pattern of the group in terms of interaction among participants. This analysis involved computing the conditional probabilities of each participant following (i.e., responding to) each other participant within the group; and it provided a structural description of the group in terms of who spoke to whom, and who followed whom within the group interaction. It was an analysis of the speaker-switching rules or norms that existed within the groups (Duncan & Fiske, 1979) and provided information on the organization and flexibility of turn-taking within therapy. This analysis was, in some respects, a sort of dynamic sociogram of the group.

A series of information theory measures (Attneave, 1959; Losey, 1978) were computed on these conditional and unconditional probabilities. Information theory (also called multivariate information transmission analysis) is derived from Shannon and Weaver's (1949) mathematical theory of communication. The approach provides a number of indices of the organization and patterning of sequentially occurring events or behaviors (such as speaker-switching or turn-taking within group interaction). These indices include: (a) entropy, (b) maximum entropy, (c) relative entropy, (d) redundancy, and (e) response ambiguity.

By way of explanation of these measures:

Entropy is a measure of the degree of randomness or disorganization of events. As pertains to group interaction, the measure serves as an index of the randomness or disorganization of the groups' interaction/process. The more random the occurrence of the interactive behaviors within the groups (i.e., the greater the entropy), the less structured the group process. Entropy may be thought of as associated with the amount of "freedom" participants have in

emitting their responses. Under high structure (e.g., under conditions of established group norms), entropy may be expected to be low and participants may be expected to have limited "choice" in when responses will be emitted, since who speaks to whom may be reasonably predictable (low randomness).

Maximum entropy is the entropy value for a set of events (in this instance, speaking turns) when the events are all equally likely, i.e., when randomness and disorganization among the events is maximal. As pertains to group processes, it would be the value of the entropy index for the group interaction if responses by the participants were equally likely (i.e., if the unconditional probabilities of occurrence of the participant responses were all equal). Under conditions of maximum entropy, speaker-switching ("turn-taking") within the groups would be random and the social interaction of the groups would lack coherence. Participant responding would be "chaotic."

Both the entropy and maximum entropy measures are influenced by the number of speakers (response codes) available within the interaction. The larger the number of speakers (response codes), the greater the "randomness" or "shuffledness" possible within the interaction. For this reason, a "standardized" measure of entropy is needed in order to allow for comparison across groups. This measure is referred to as relative entropy.

The relative entropy index is the ratio of the actual entropy of a set of events (i.e., the actual degree of disorganization of those events) to the maximum possible degree of disorganization of the events (maximum entropy). As pertains to the group processes under investigation, it serves as an index of the degree of response freedom in the group process, relative to the maximum response freedom that could exist.

Redundancy, in contrast to the entropy measure, is an index of response patterning. As it relates to this study, it is a measure of the structure of the group interaction that is determined not by the "free choice" of the participants, but rather by the constraint (conditional responding) inherent in their interaction.

The response ambiguity measure is an index of the decrease in the uncertainty of the participants' responses (consequents) given knowledge of the immediately preceding speaker. This measure provides a useful index of the relative influence (dominance, in contrast to "domineeringness") each group participant has on the responding of the others in the group, and on the group

as a whole. Specifically, the antecedent speaker with the smaller ambiguity index (relative to the other participants) may be considered as evidencing the greater influence on the distribution of responses by the other members of the group (i.e., providing the greater decrease in the uncertainty in the others' responding). The reasoning behind this interpretation of the measure is this: The less "ambiguous" or uncertain participants are in their responding to another speaker, the more predictable they are in their responding. To the extent that there is an asymmetry in the predictability of the contingent responding of the participants in the group, the individual whose responding results in most predictable responding of the others is the person with the most control or influence--i.e., the individual whose responding imposes the most structure on the group.

The information theory measures were calculated for each session of each therapy group. Comparisons of the measures for a group across its series of group sessions were analyzed for patterns suggestive of "stages." The patterns in the information theory measures/indices were a function of the number of participants who were interactive within the group sessions, the diversity of their responding, and the dependency/contingency among the speakers' responses--thereby addressing the issues of "complexity" and "organization" in the group's interaction and permitting investigation of the changes in those constructs over the course of the groups' sessions. Comparisons were also made among the four therapy groups in an attempt to identify patterns of structure or structural change (i.e., "stages") that were common across the different groups.

Results

Table 1 summarizes the maximum entropy, entropy, relative entropy and redundancy for each of the four groups across its series of group sessions. The maximum entropy value for each group was based on the total (maximum) group membership for that group, and this index remained constant across the group's sessions. All other measures of structure/organization were determined using the actual number of members present for a given group session. This procedure reflects our assumption that the actual entropy (and thus the relative entropy and redundancy) of a group's interaction is a function not only of the

group members that are present at any given group session, but also of the members who are silent or absent during the session--an assumption generally supported by the literature (e.g., Yalom, 1985).

Insert Table 1 about here

Figures 1 through 4, respectively, present the entropy across sessions for each of the four groups. Across the groups, little change was seen in the entropy of the interaction. In Group 1, a slight decrease in entropy was noted, suggesting a change toward increased structure across its six sessions. Group 2 showed a slight overall increase in entropy, suggesting increasing "chaos" across the nine sessions. Group 3 evidenced a slight decrease in entropy after the first group session, with a swing back toward its original level of entropy on its final session. Group 4 showed little or no change in organization across its seven session.

Insert Figures 1 through 4 about here

Redundancy showed a similar pattern across sessions for the four groups (see Figures 5 through 8). Group 1 showed a marked increase in redundancy across its six sessions, suggesting an increased structuring of the group's interaction across sessions. Group 2 showed an overall decrease in redundancy (a decrease in structure or organization) in the group's responding. In certain respects, Groups 1 and 2 are "mirrors" of each other: Group 1 began as relatively unstructured, reaching a "peak" of structure midway through the group (session 3), then becoming less structured, and again reaching a "peak" of structure at the final session. Group 2 began as fairly structured, becoming increasingly less structured until its midpoint (session 4) at which point it regained structure, and then moving again toward less structure and organization.

Insert Figures 5 and 6 about here

Group 3 evidenced a slight "curvilinear" pattern in redundancy across its sessions, beginning as reasonably unstructured, maintaining some organization across its middle sessions, and returning to disorganization on the final session. Group 4 appeared to evidence a slight increase in structure across its sessions, but nothing as dramatic as that evidenced by Group 1.

Insert Figures 7 and 8 about here

No significant differences were found among the four groups in terms of their overall redundancy or patterning, $F(3, 25) = 1.054$, $p > .05$ (see Table 2). Response redundancy values ranged from .20 to .26, suggesting that only 20% to 26% of the structure within the groups' interaction was a function of constraint inherent in the interaction itself, rather than by the response freedom of the group participants.

Figure 9 displays the relative entropy (the "standardized" measure of entropy) for each of the four groups across its respective sessions. No obvious pattern of "stages" of structural organization appeared across the four groups. Instead, each seemed to have its own unique pattern of organizational development across its group sessions. Despite the unique patterning of the groups' organization across sessions, no difference was found among the groups in their overall degree of organization, $F(3, 25) = 1.082$, $p > .05$ (see Table 3). In general, the groups' interaction remained unstructured and displayed considerable disorganization. Relative entropy values ranged from .74 to .80, suggesting that participants in the groups were between 74% and 80% as free as they could be in their interaction; that is, there appeared to be little constraint upon the interaction within the four groups.

Insert Figure 9 about here

Of interest in the literature has been the relation between attempted dominance (domineeringness) and achieved dominance (relative influence) in social interaction (Lichtenberg & Paolo, 1984; Millar-Rogers & Millar, 1979; Tracey, 1985, 1986). A participant's domineeringness, also referred to as

"attempted dominance" (Wampold, 1988), was measured as the number of times the individual spoke during the group session; the more frequently the individual spoke, the greater the speaker's domineeringness (attempted dominance). A group member's dominance (or achieved dominance) was measured as the ambiguity of the other group members' speaking behavior given that the participant has just spoken. The more predictable the group's interaction following a speaking turn by one of the participants (i.e., the less ambiguous their responding and the lower the ambiguity index), the more influential or dominant that participant is with respect to the group process.

Table 4 summarizes the correlations between individual participants' scores on these two measures for each of the four groups across the group's session. Figure 10 presents those same correlations as a time series graph.

Insert Table 4 and Figure 10 about here

Interpreting these correlations is not entirely straight forward. It must be kept in mind that high ambiguity scores suggest low achieved dominance. The more ambiguous the group's responding given that a particular participant has just spoken, the less actual or achieved dominance that participant has over the interaction within the group. In this regard, the generally high positive correlations between attempted and achieved dominance suggest an inverse relationship between the two measures. That is, the more frequently an individual spoke during a group sesssion, the less dominance or influence the person actually achieved over the group interaction.

Yalom (1985) has proposed that as therapy groups develop, they should become increasingly "leaderful"; that is, leadership or dominance initially vested in the designated group leaders should, over time, become vested in the group members--whether through the leaders' relinquishing their "leader role" or through the group members becoming increasingly effective at managing the group's interaction. To investigate this phenomenon, for each group we charted the attempted and achieved dominance of the group's co-leaders against that of the group members. Figures 11 through 14 display the attempted dominance of the groups' co-leaders (L1 = primary group leader, L2 = co-leader) against the

mean attempted dominance of the group members, across the groups' sessions.

Insert Figures 11 through 14 about here

Group 1 revealed little in the way of movement toward the group becoming more "leaderful." Group 2 revealed an oscillation in the co-leaders' behavior toward a rather stable "middle level" of attempted dominance defined by the group members. A similar pattern was found in Group 3. In Group 3, however, it should be noted that following the first session, the co-leader (L2) became exceptionally domineering, with this domineeringness tapering toward a level of attempted dominance that seemed to be shared by the primary leader (L1) and the group membership. In Group 4, the primary leader (L1) was the more domineering of the co-leaders, becoming increasingly domineering across the group sessions.

Figures 15 through 18 display the achieved dominance of the groups' co-leaders against the mean achieved dominance of the groups' members across the groups' sessions. The achieved dominance of the co-leaders and group members for Group 1 was nearly identical, showing a slight overall decrease in achieved dominance across the group's session. Achieved dominance across Group 2 for the co-leaders and group members was also quite similar, showing a slight overall increase in achieved dominance across the group's sessions. The co-leaders in Group 3 shared a similar pattern of achieved dominance across the group, but a pattern suggestive of slightly less actual dominance over the group's interaction than that of its members. [Higher ambiguity indices are indicative of lower achieved dominance.] In Group 4, the primary leader (L1) appeared to be less influential over the group interaction than did the group members themselves.

Insert Figures 15 through 18 about here

Conclusion

Although the groups varied in their organization and flexibility across sessions, no consistent pattern of responding was found across the four therapy groups. Neither within nor across groups did a pattern of organization suggestive of "stages" of group process emerge.

All four groups displayed considerable flexibility and little structure or organization in their members' responding. The absence of outcome measures for the groups, in addition to the absence of reliable differences among the various groups' interactional structures, makes it impossible to know whether the degree of entropy (and lack of patterning or redundancy) that characterized these groups was helpful or detrimental to the groups' functioning as a therapeutic modality. Consequently, whether more or less structure might improve the efficacy of the groups cannot be known from this study.

The finding of an inverse relationship between attempted and achieved dominance was in general accord with other recent studies of dominance within social interaction (Rogers-Millar & Millar, 1979; Tracey, 1986), and is reflective of the clinical phenomenon that silence (or low attempted dominance) within a social setting can have an extremely powerful effect on interaction (i.e., high achieved dominance).

The data presented in Figures 11 through 18 suggest that, despite fluxuations in the co-leaders' attempted dominance within their groups, achieved dominance was fairly consistently shared among the co-leaders and the group members. A progressive change from leader dominance to (a) member dominance or (b) shared dominance was not found in the groups.

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Author Notes

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Table 1

Maximum entropy, entropy, relative entropy and redundancy for groups across sessions.

Group 1 (Max. entropy = 3.46, based on N = 11)

	Entropy	Rel. Entropy	Redundancy
Session 1	3.10	.89	.11
Session 2	2.96	.86	.14
Session 3	2.25	.65	.35
Session 4	2.54	.74	.26
Session 5	2.31	.67	.33
Session 6	2.20	.63	.37

Group 2 (Max. entropy = 3.32, based on N = 10)

	Entropy	Rel. Entropy	Redundancy
Session 1	2.42	.73	.27
Session 2	2.68	.81	.19
Session 3	2.67	.81	.19
Session 4	2.75	.83	.17
Session 5	2.45	.74	.26
Session 6	2.64	.79	.21
Session 7	2.52	.76	.24
Session 8	2.79	.84	.16
Session 9	2.93	.88	12

Table 1 (cont.)

Group 3 (Max. entropy = 3.17, based on N = 9)

	Entropy	Rel. Entropy	Redundancy
Session 1	2.72	.86	.14
Session 2	2.33	.74	.26
Session 3	2.33	.74	.26
Session 4	2.48	.78	.22
Session 5	2.46	.77	.23
Session 6	2.28	.72	.28
Session 7	2.73	.86	.14

Group 4 (Max. entropy = 3.58, based on N = 12)

	Entropy	Rel. Entropy	Redundancy
Session 1	2.87	.80	.20
Session 2	2.95	.82	.18
Session 3	2.77	.77	.23
Session 4	2.95	.82	.18
Session 5	2.81	.78	.22
Session 6	2.78	.77	.23
Session 7	2.75	.77	.23

Table 2
Differences in redundancy between groups.

Group 1		Group 2		Group 3		Group 4	
M	SD	M	SD	M	SD	M	SD
.26	.11	.20	.05	.22	.06	.21	.02

Source	SS	df	MS	F	p
Group	.014	3	.005	1.054	.375
Error	.104	25	.004		

$F(3, 25) = 1.054$ $p > .05$

Table 3
Differences in relative entropy between groups.

Group 1		Group 2		Group 3		Group 4	
M	SD	M	SD	M	SD	M	SD
.74	.11	.80	.05	.78	.06	.79	.02

Source	SS	df	MS	F	p
Group	.014	3	.005	1.082	.375
Error	.104	25	.004		

$F(3, 25) = 1.082$ $p > .05$

Table 4

Correlations between attempted and achieved dominance across sessions by group.

Group	Session								
	S1	S2	S3	S4	S5	S6	S7	S8	S9
1	.825	.871	-.485	.222	.072	.828			
2	.600	.816	.842	.595	.510	.892	.599	.972	.262
3	.855	.545	.435	.604	.442	.756	.449		
4	.856	.863	.733	.898	.695	.707	.827		

Figure Captions

Figure 1. Entropy across sessions: Group 1.

Figure 2. Entropy across sessions: Group2.

Figure 3. Entropy across sessions: Group 3.

Figure 4. Entropy across sessions: Group 4.

Figure 5. Redundancy across sessions: Group 1.

Figure 6. Redundancy across sessions: Group 2.

Figure 7. Redundancy across sessions: Group 3.

Figure 8. Redundancy across sessions: Group 4.

Figure 9. Relative entropy by groups by session.

Figure 10. Correlation between attempted and achieved dominance.

Figure 11. Group 1 member and leader attempted dominance.

Figure 12. Group 2 member and leader attempted dominance.

Figure 13. Group 3 member and leader attempted dominance.

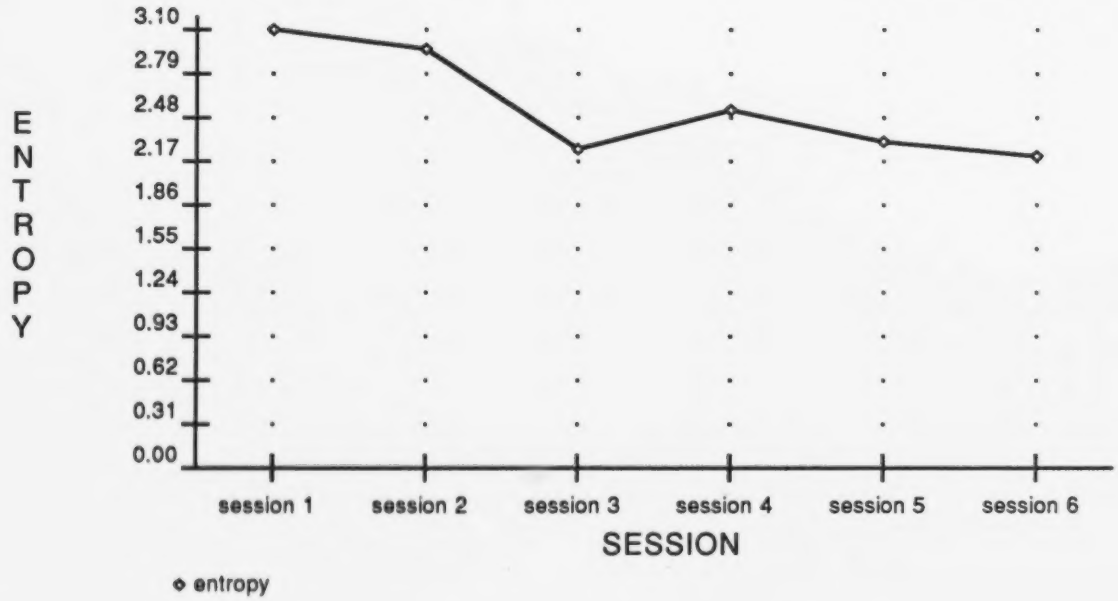
Figure 14. Group 4 member and leader attempted dominance.

Figure 15. Group 1 member and leader achieved dominance.

Figure 16. Group 2 member and leader achieved dominance.

Figure 17. Group 3 member and leader achieved dominance.

Figure 18. Group 4 member and leader achieved dominance.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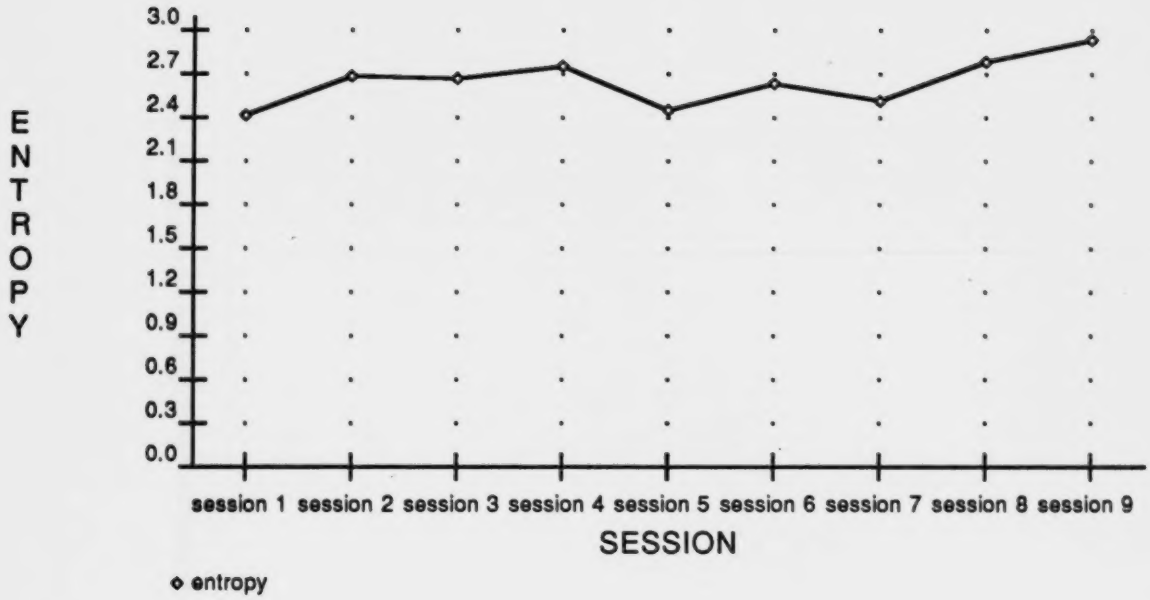
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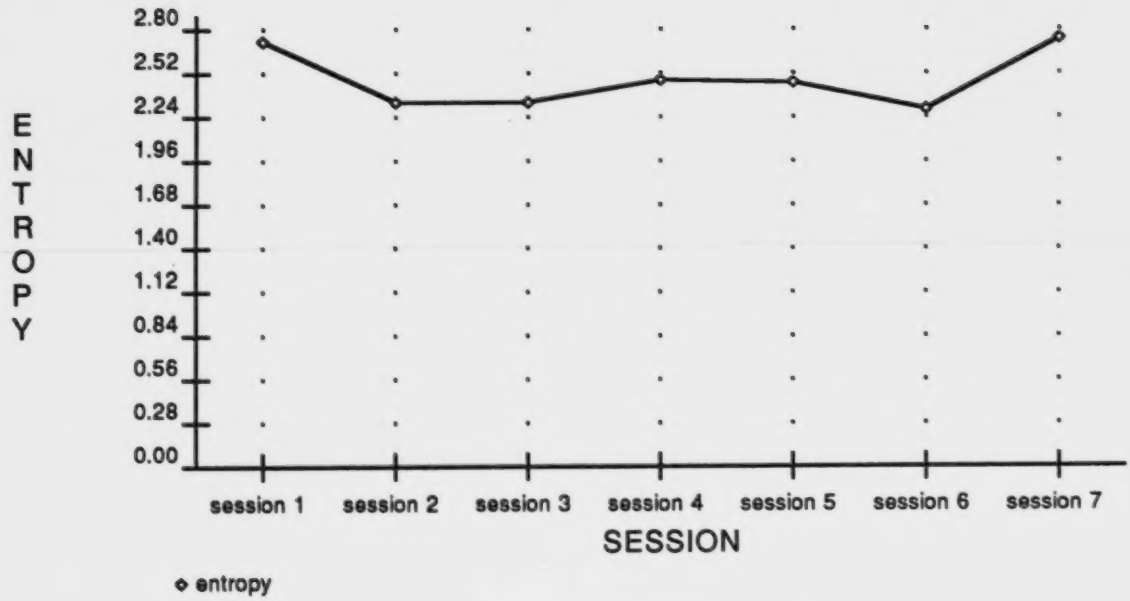
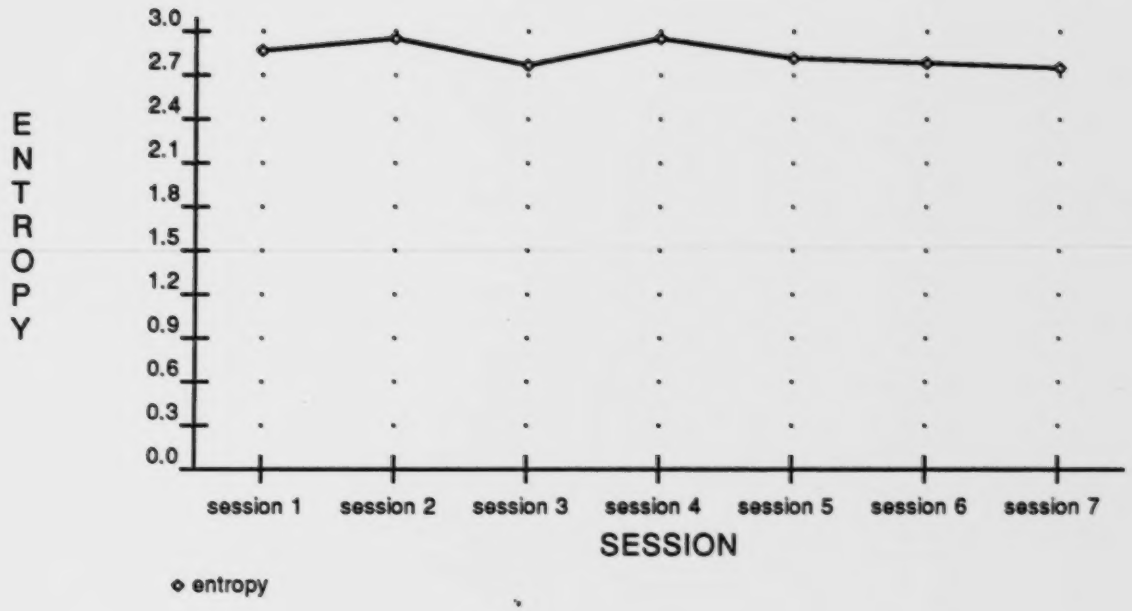
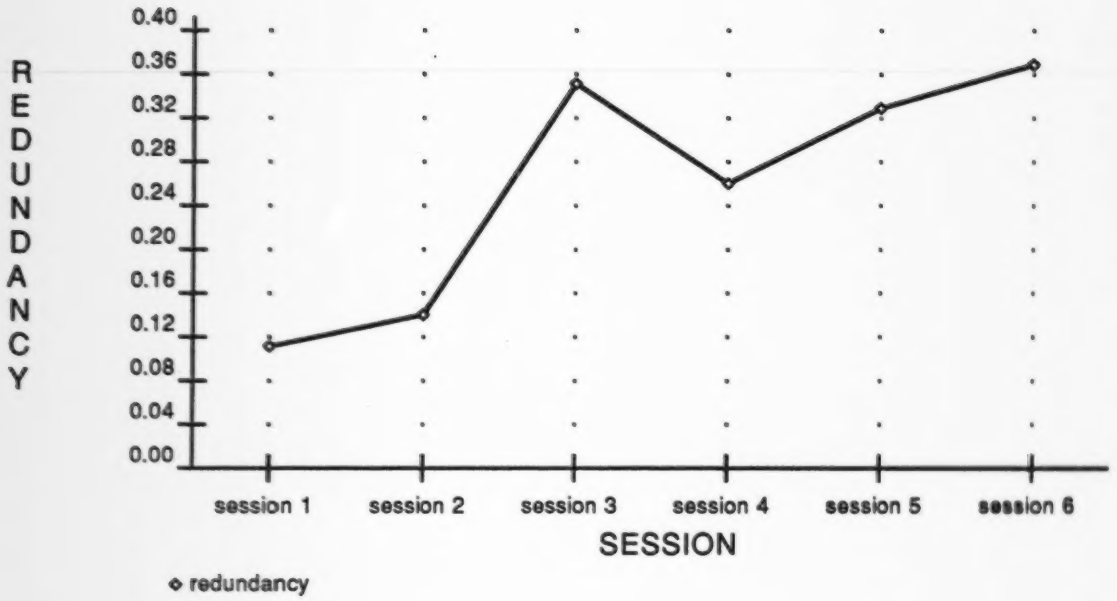
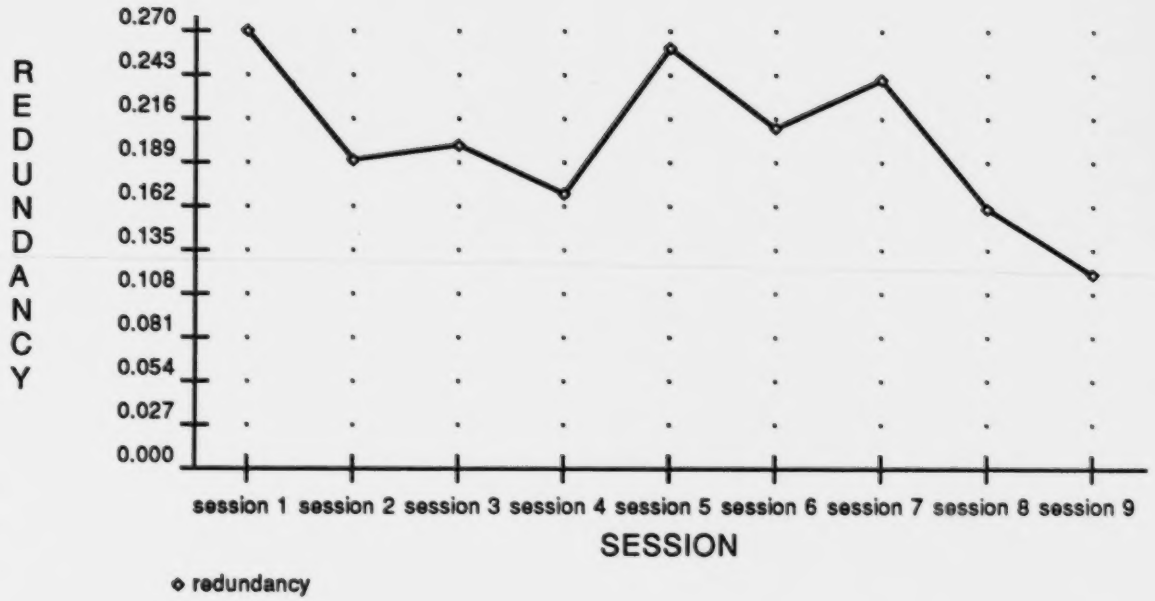
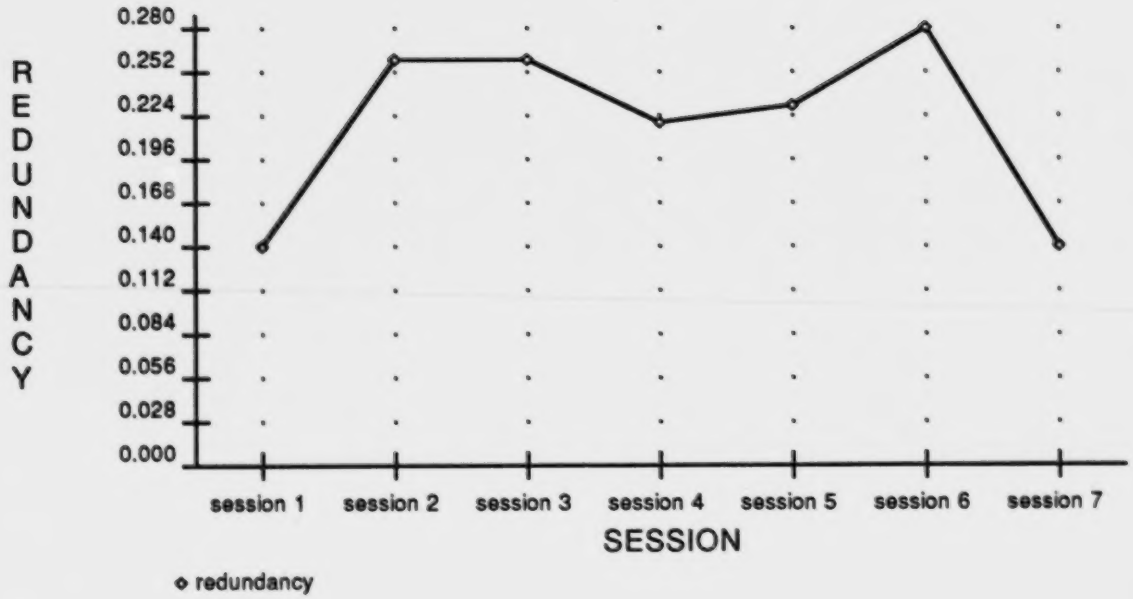
session 1 session 2 session 3 session 4 session 5 session 6 session 7 session 8 session 9
SESSION
◇ entropy

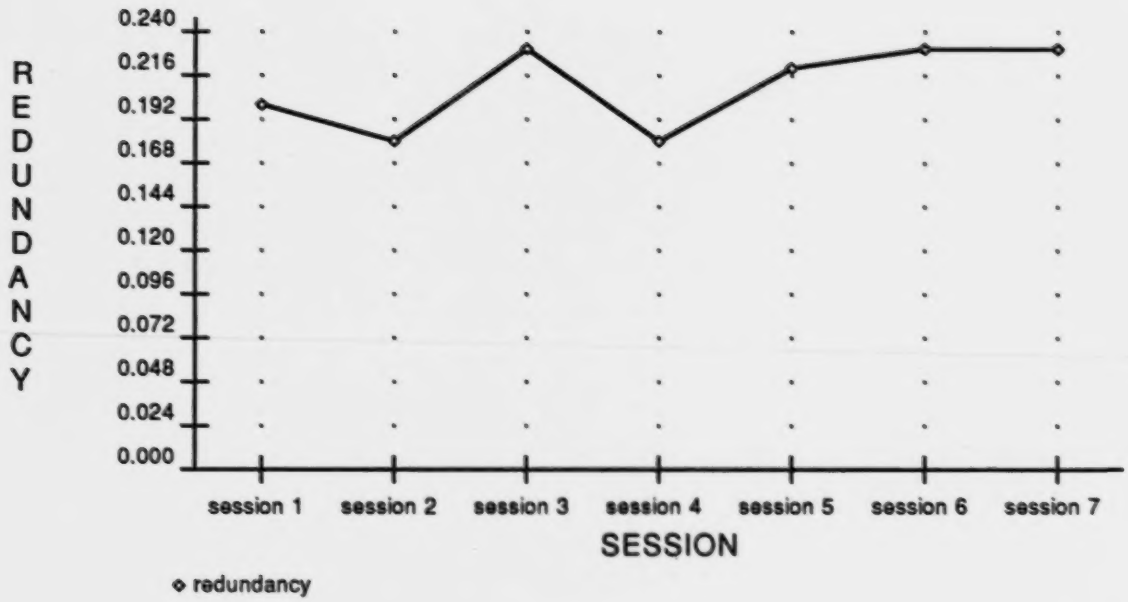

ENTROPY
2.80
2.52
2.24
1.96
1.68
1.40
1.12
0.84
0.56
0.28
0.00
session 1
session 2
session 3
session 4
session 5
session 6
session 7
SESSION
entropy

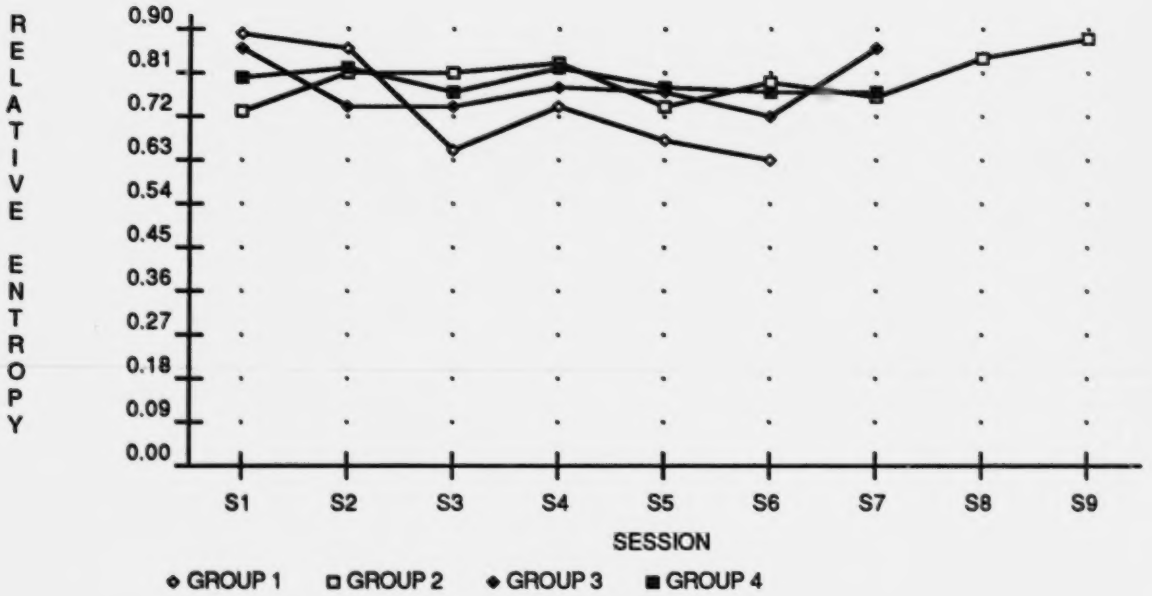

ENTROPY
3.0
2.7
2.4
2.1
1.8
1.5
1.2
0.9
0.6
0.3
0.0
session 1
session 2
session 3
session 4
session 5
session 6
session 7
SESSION
entropy

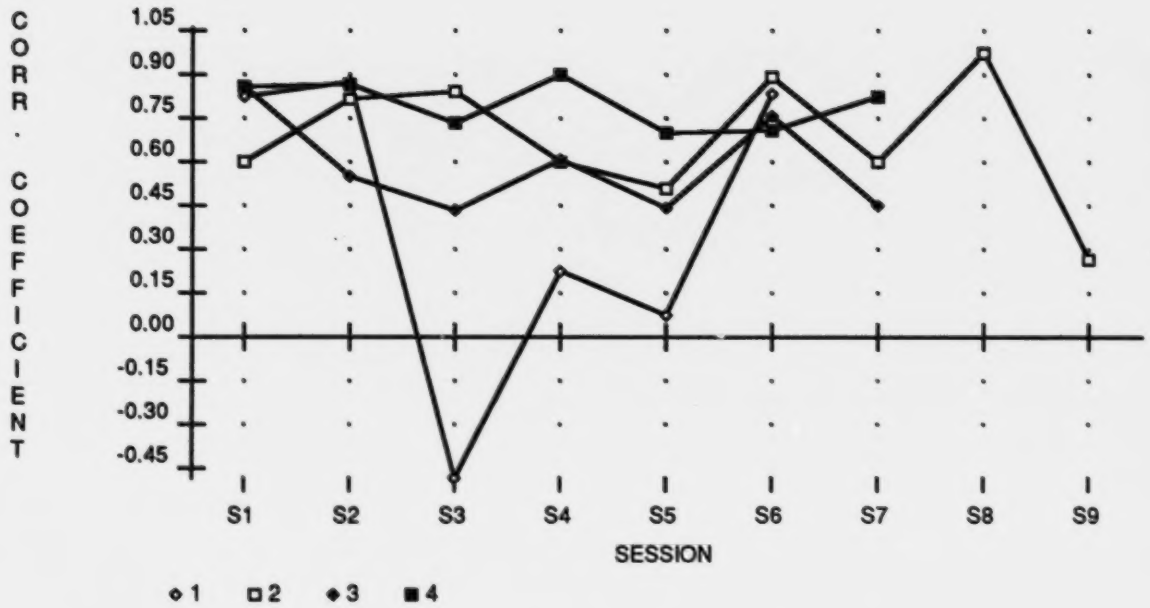

REDUNDANCY
0.40
0.36
0.32
0.28
0.24
0.20
0.16
0.12
0.08
0.04
0.00
session 1
session 2
session 3
session 4
session 5
session 6
SESSION
redundancy

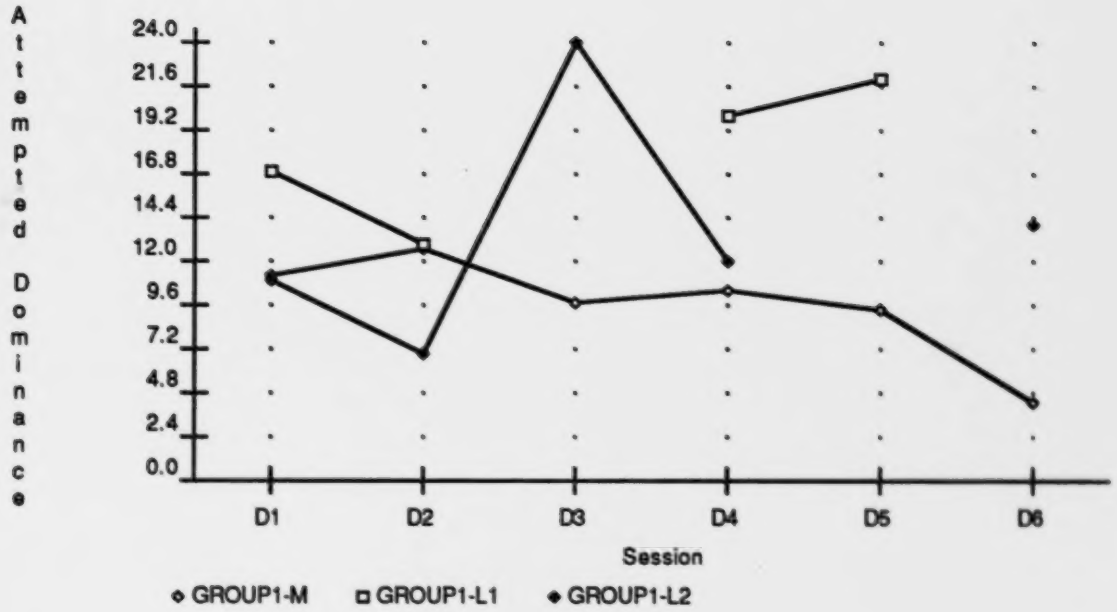

REDUNDANCY
0.270
0.243
0.216
0.189
0.162
0.135
0.108
0.081
0.054
0.027
0.000
session 1 session 2 session 3 session 4 session 5 session 6 session 7 session 8 session 9
SESSION
redundancy

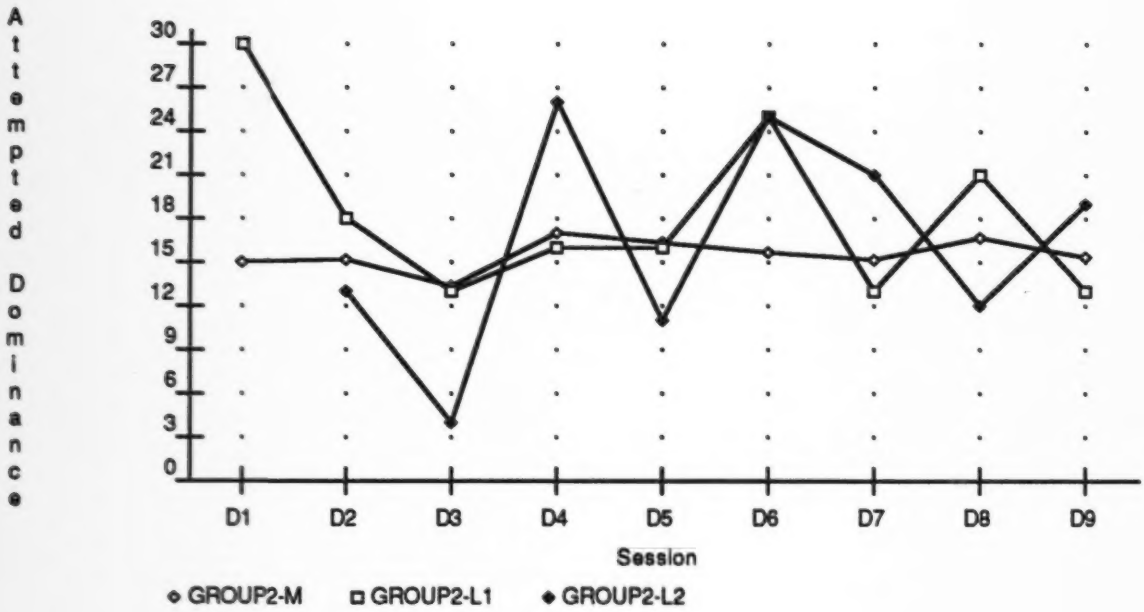

REDUNDANCY
0.280
0.252
0.224
0.196
0.168
0.140
0.112
0.084
0.056
0.028
0.000
session 1
session 2
session 3
session 4
session 5
session 6
session 7
SESSION
redundancy

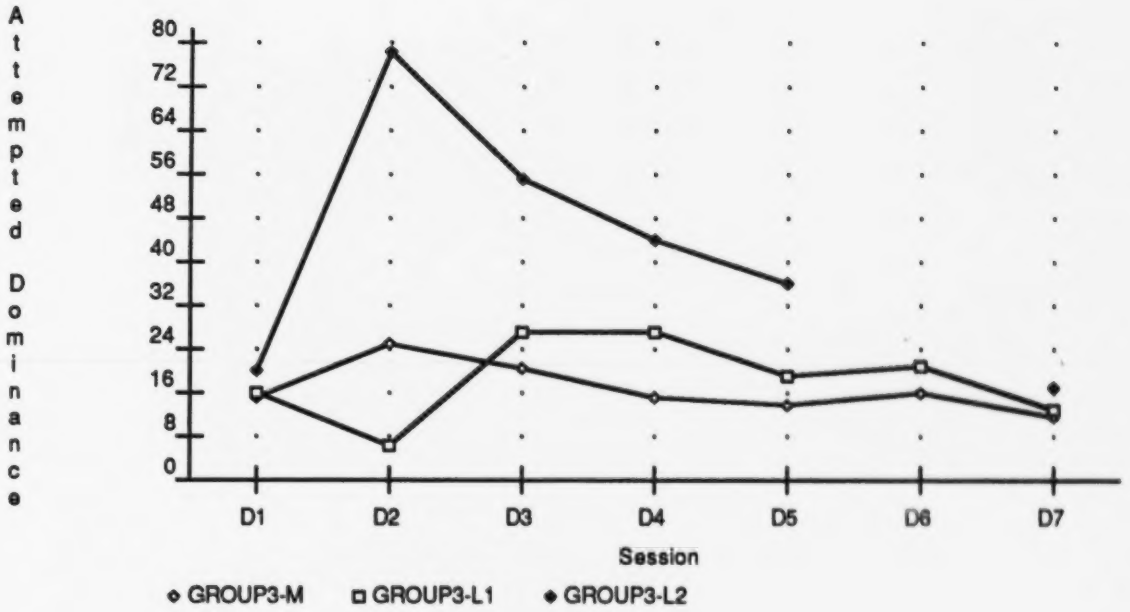

REDUNDANCY
0.240
0.216
0.192
0.168
0.144
0.120
0.096
0.072
0.048
0.024
0.000
session 1
session 2
session 3
session 4
session 5
session 6
session 7
SESSION
redundancy

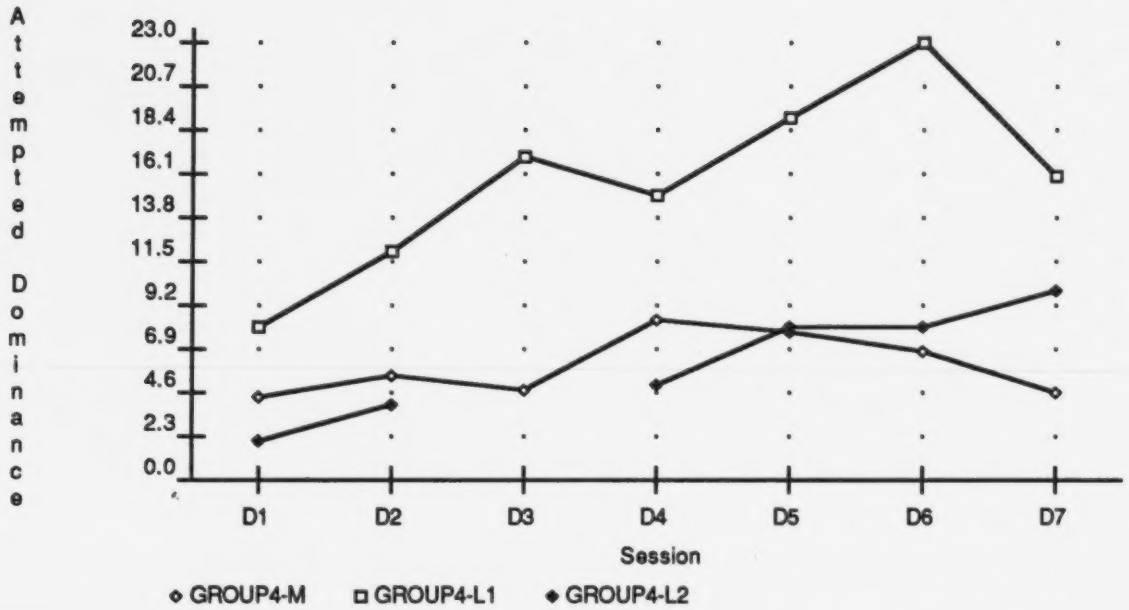

RELATIVE ENTROPY
0.90
0.81
0.72
0.63
0.54
0.45
0.36
0.27
0.18
0.09
0.00
S1
S2
S3
S4
S5
S6
S7
S8
S9
SESSION
GROUP 1
GROUP 2
GROUP 3
GROUP 4

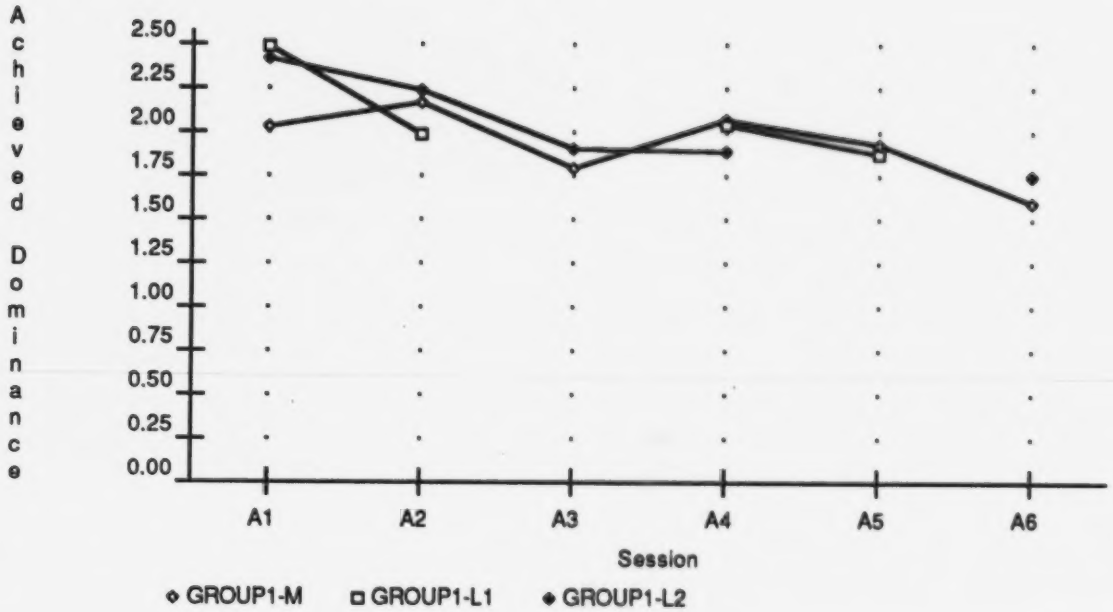

CORR. COEFFICIENT
1.05
0.90
0.75
0.60
0.45
0.30
0.15
0.00
-0.15
-0.30
-0.45
S1
S2
S3
S4
S5
S6
S7
S8
S9
SESSION
1
2
3
4

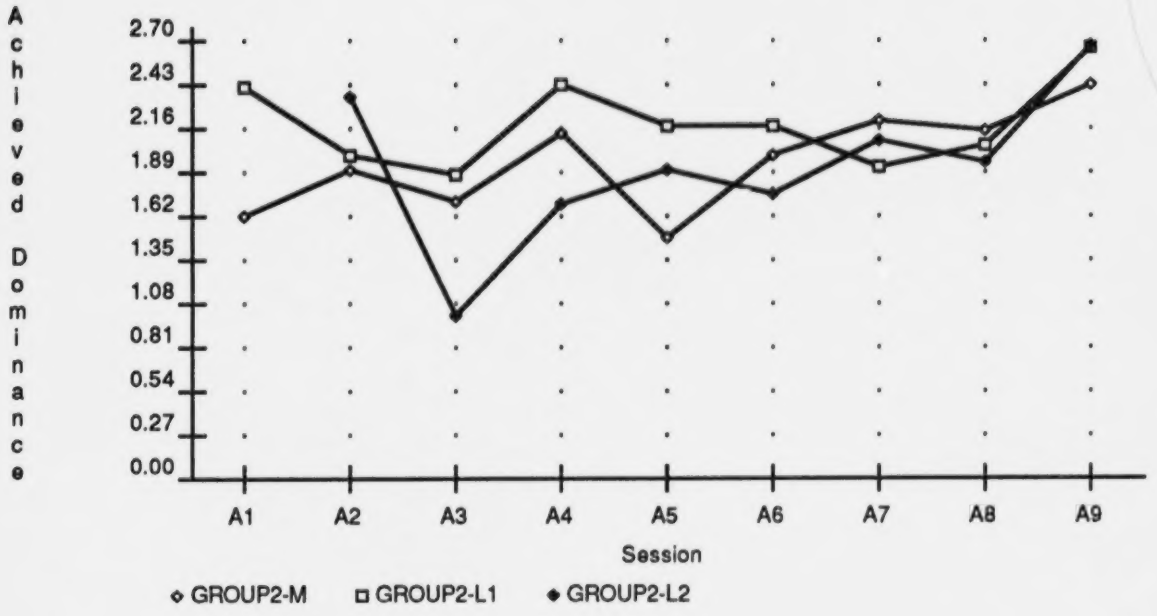

Attempted Dominance
24.0
21.6
19.2
16.8
14.4
12.0
9.6
7.2
4.8
2.4
0.0
D1
D2
D3
D4
D5
D6
Session
GROUP1-M
GROUP1-L1
GROUP1-L2

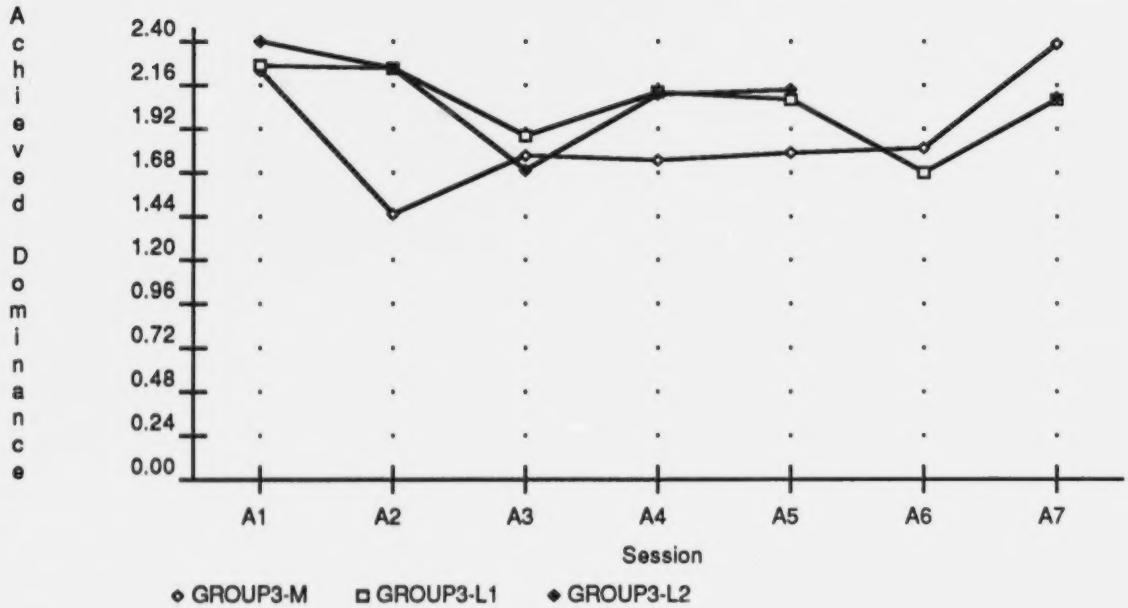

Attempted Dominance
30
27
24
21
18
15
12
9
6
3
0
D1
D2
D3
D4
D5
D6
D7
D8
D9
Session
GROUP2-M
GROUP2-L1
GROUP2-L2

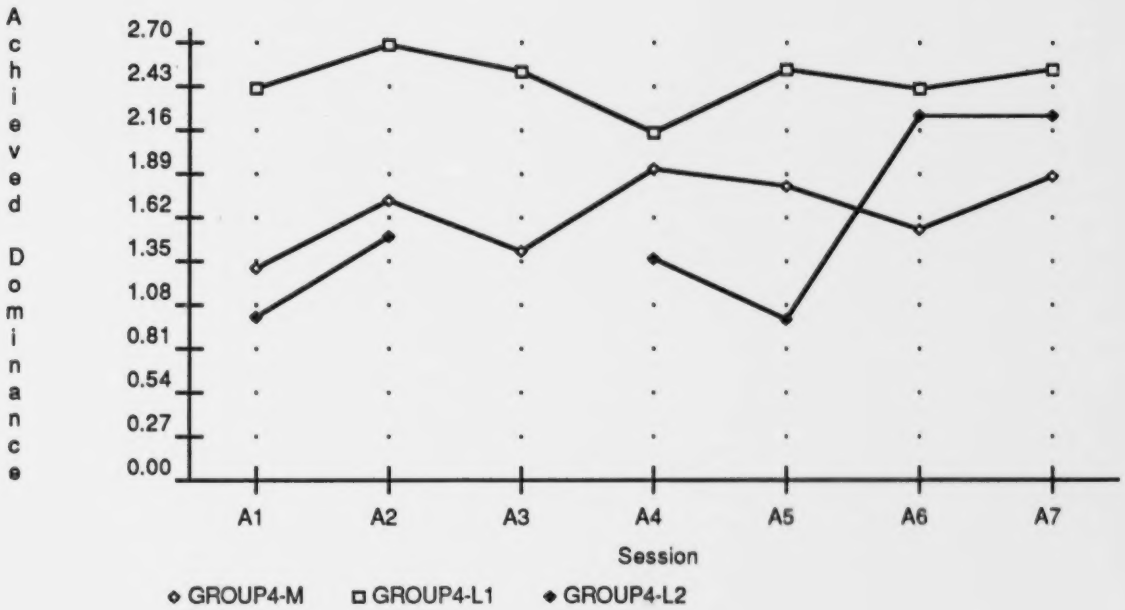

Attempted Dominance
80
72
64
56
48
40
32
24
16
8
0
D1
D2
D3
D4
D5
D6
D7
Session
GROUP3-M
GROUP3-L1
GROUP3-L2


Attempted Dominance
23.0
20.7
18.4
16.1
13.8
11.5
9.2
6.9
4.6
2.3
0.0
D1
D2
D3
D4
D5
D6
D7
Session
GROUP4-M
GROUP4-L1
GROUP4-L2


Achieved Dominance
2.50
2.25
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
A1
A2
A3
A4
A5
A6
Session
GROUP1-M
GROUP1-L1
GROUP1-L2


Achieved Dominance
2.70
2.43
2.16
1.89
1.62
1.35
1.08
0.81
0.54
0.27
0.00
A1
A2
A3
A4
A5
A6
A7
A8
A9
Session
GROUP2-M
GROUP2-L1
GROUP2-L2


Achieved Dominance
2.40
2.16
1.92
1.68
1.44
1.20
0.96
0.72
0.48
0.24
0.00
A1
A2
A3
A4
A5
A6
A7
Session
GROUP3-M
GROUP3-L1
GROUP3-L2


Achieved Dominance
2.70
2.43
2.16
1.89
1.62
1.35
1.08
0.81
0.54
0.27
0.00
A1
A2
A3
A4
A5
A6
A7
Session
GROUP4-M
GROUP4-L1
GROUP4-L2